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Global Smartphone Sales May Have Peaked: What Next?

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Global Smartphone Sales May Have Peaked: What Next?

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Abstract

Global smartphone sales may have peaked. After reaching nearly 1.5 billion units in 2016, global smartphone sales have since declined, contributing negatively to world trade in 2019 and suggesting that the global market may now be saturated. This paper develops a simple model to forecast smartphone sales, which shows that sales are likely to decline further. As tech companies shift to embedded services (cloud computing, content subscriptions, and financial services), the impact on global trade may also be shifting in favor of services exports mostly from advanced economies.

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CONTENTS

I. INTRODUCTION

Global smartphone sales may have peaked. After reaching close to 1.5 billion units sold in 2016, global smartphone sales have since declined, suggesting that the global market for smartphones may be saturated. As a result, the contribution of smartphones to global merchandise trade was negative in 2019. This is likely to continue as the growth of global smartphones sales slows and their replacement cycle lengthens.

This paper provides an update to an earlier working paper (WP/18/22), where sales were predicted to peak as the global market for smartphones saturated. This paper shows that those predications may have come true, explaining part of the recent weakness in global trade. In addition, as tech companies shift to embedded services (cloud computing, content subscription, and financial services), the contribution to global trade over the next few years could shift from merchandise exports mostly from Asia to services exports mostly from advanced economies. This is likely to reduce the volatility of the tech cycle on high-frequency trade data as services exports are likely to be smoother.

The paper is organized as follows. Section II describes the recent peak of global smartphone sales and the evolution of the global supply chain. A simple model of global smartphone sales is presented in Section III. Section IV discusses the shift to embedded services and the implications for global trade. Section V concludes.

II. GLOBAL SMARTPHONE SALES MAY HAVE PEAKED

Following a peak in 2016 at 1.47 billion units, global smartphone sales have come down to 1.37 billion in 2019 (Figure 1). The dynamics of global smartphone sales now resembles that of personal computer (PC) sales, which peaked in 2011 followed by a steady decline thereafter as PC technology matured. The average price of a smartphone has also declined as cheaper producers (Huawei, Samsung, Xiaomi, Oppo) have gained market share at the expense of Apple, the industry leader (Table 1). These trends in both quantities and prices suggest that the global smartphone market may now be saturated.

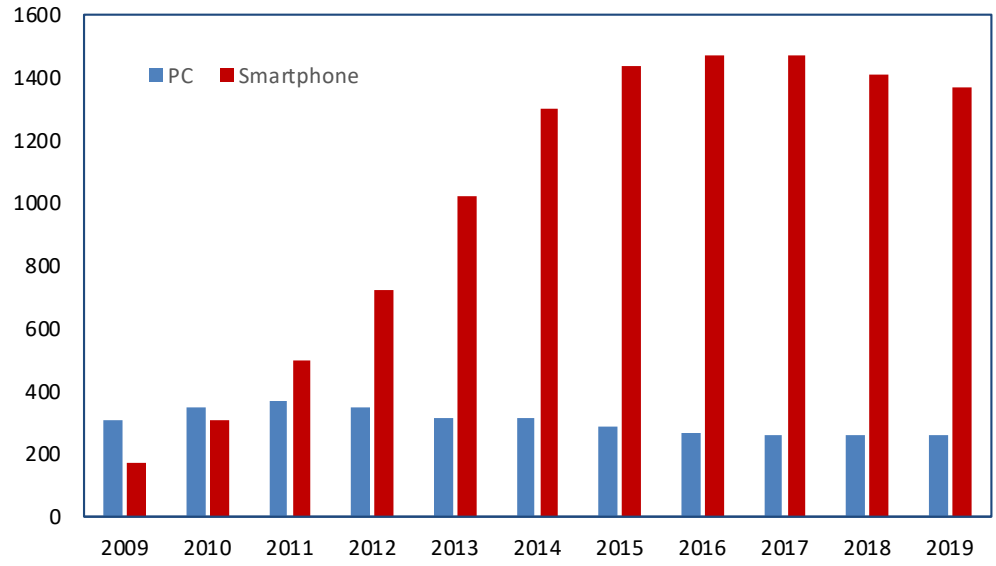
Apple iPhone sales provide further evidence of the decline in global smartphone sales. The official Apple Inc. sales figures published in the company's quarterly financial statements show that iPhone sales peaked in 2015 with the release of the iPhone 6S (September 2015). Sales then started declining in 2016-17 (Figure 2). Apple, Inc. stopped publishing quarterly figures for iPhone sales in the fourth quarter of 2018. However, IDC estimates show a continued decline since then.[1] In 2019, these estimates show an 8.7 percent decline in iPhone sales, compared with the same period the previous year, partly reflecting the overall decline in global smartphone shipments and an erosion of Apple's market share, particularly in

[1] IDC (2020).

(continued…)

China. Nevertheless, iPhone releases continue to drive the quarterly pattern of the tech cycle as they establish the benchmark for other smartphone producers to follow.[2]

Figure 1. Global Sales of PCs and Smartphones
(Millions of Units)



Sources: Gartner (2020), IDC (2020).

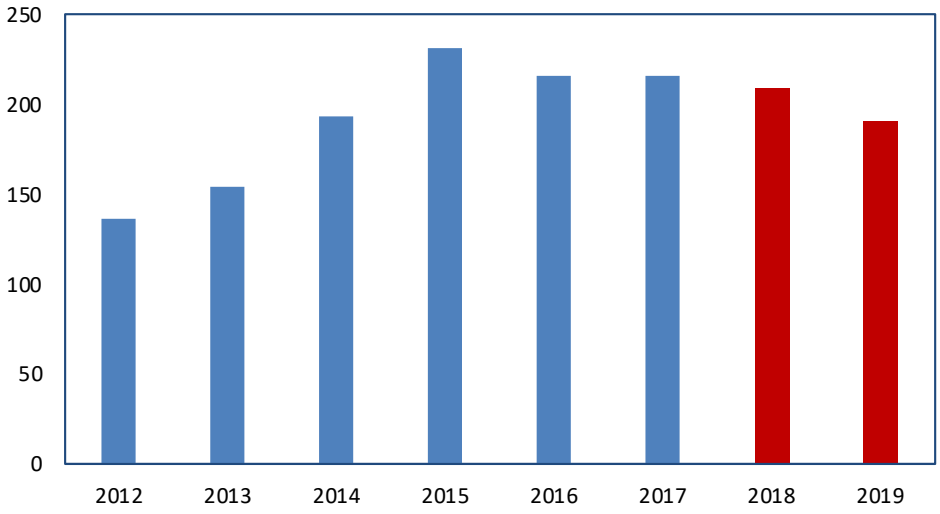
Table 1. Smartphone Shipments and Market Share by Company

Company	2018 Shipments (millions)	2018 Market Share (%)	2019 Shipments (millions)	2019 Market Share (%)	Year-Over-Year Change (%)
1. Samsung	292.3	20.8	295.0	21.5	0.9
2. Huawei	206.0	14.7	240.6	17.5	16.8
3. Apple	208.8	14.9	190.6	13.9	-8.7
4. Xiaomi	122.6	8.7	122.8	9.0	0.2
5. OPPO	113.2	8.1	114.4	8.3	1.1
Others	462.1	32.9	407.7	29.7	-11.8
Total	**1404.9**	**100.0**	**1371.1**	**100.0**	**-2.4**

Source: IDC (2020).

[2] See Carton, B., J. Mongardini, and Y. Li (2018).

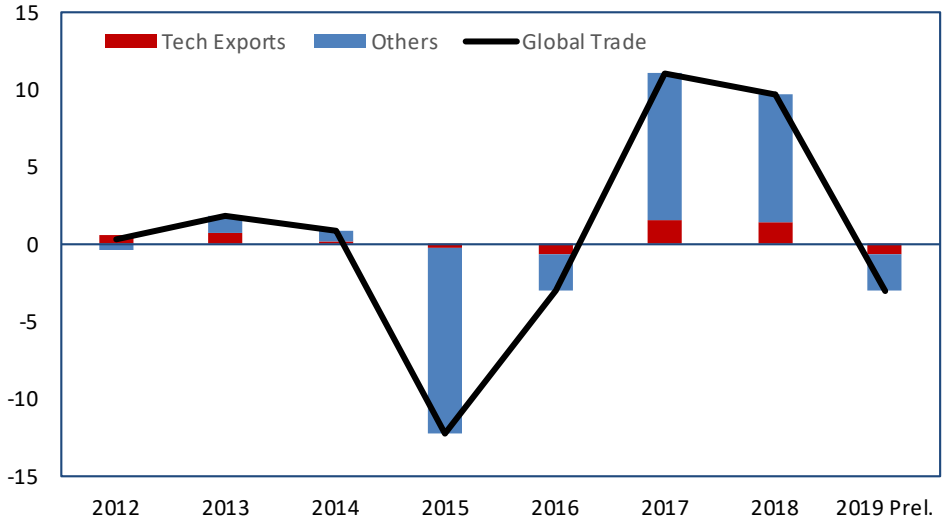
Figure 2. Global iPhone Sales
(Millions of Units Sold Each Year)



Sources: Apple Inc. quarterly financial statements up to 2018Q3 (quarters shown are calendar and not fiscal year). IDC (2020) estimates of iPhone sales from 2018Q4 to 2019Q4.

As a result of this decline, tech exports associated with smartphone production are estimated to have been a drag on global trade in 2019.[3] After a positive contribution in 2017-18 driven by higher prices for smartphones offsetting lower quantities, tech exports declined in 2019 as quantities and average prices both declined. As a result, tech exports are estimated to have contributed negatively to global trade in 2019 (Figure 3). This negative contribution was particularly evident in Asian exports, including from China.

Figure 3. Global Trade Decomposition
(Growth Rate of Global Trade and Contributions in US Dollars)



Sources: CPB/Haver/National Customs Data. Authors' estimates for December 2019.

[3] Tech-related exports accounted for an estimated 14 percent of global trade in 2018.

The global supply chain for smartphones continues to evolve. Following the escalation of trade tensions between the United States and China, smartphone producers have been looking at ways to diversify the global supply chain to countries outside mainland China to avoid potential tariffs (most smartphones, including iPhones, have so far been exempted from US tariffs). The iPhone assembly producer, Foxconn, for example, has announced production of future iPhone models out of Chennai, India, and new planned factories in Vietnam.[4] Suppliers of the new 5G network infrastructure (Ericsson and Huawei) are also moving production to India. Moreover, the recent outbreak of the Coronavirus has led to announced temporary shutdowns of smartphone production in mainland China.

III. A MODEL TO FORECAST FUTURE SMARTPHONE SALES

Given that global smartphone sales appear to have recently peaked, what next for smartphone sales? This section develops a very simple model to answer this question based on the global stock of smartphones in use, its possible growth rate, and an expectation of the average replacement cycle. Calibrating the model to reasonable parameters shows that global smartphone sales are likely to continue to fall over the next few years, in line with the experience of PCs after the peak in 2011. However, there is significant uncertainty surrounding this forecast. In particular, the expected decline may be reversed by the introduction of 5G-compatible smartphones, or other innovations, that could lead users to replace their smartphones faster over the next few years.

The model is based on a simple equation determining the evolution of smartphone sales. Global smartphone sales (S_t) are driven by the growth rate (γ_t) in the stock of smartphones currently in use worldwide (K_t) and a time-varying replacement cycle (μ_t), namely the average number of years users keep a smartphone before replacing it. The equation determining smartphone sales is therefore as follows:

$$S_t = \gamma_t K_{t-1} + \frac{K_{t-1}}{\mu_t} = (\gamma_t + \frac{1}{\mu_t}) K_{t-1}$$

Accordingly, if the growth rate of the stock of smartphones is larger than the drag from the lengthening of the replacement cycle, sales will rise and vice versa. [5]

The steady state of the model is given by a desired capital stock of global smartphones (K^*) and a steady-state replacement cycle (μ^*), while the steady-state growth rate of the capital

[4] See Economic Times (2019) and ANZ Research (2019).

[5] This equation applies for positive sales ($S_t \geq 0$). If $\gamma + \frac{1}{\mu_t} \leq 0, S_t = 0$ and the stock of global smartphones would diminish rapidly. This is, however, unlikely as it would imply that smartphones would not be replaced and eventually disappear ($K_t = 0$).

stock is zero ($\gamma = 0$). Accordingly, smartphone sales in the steady state are equivalent to the replacement cycle of the desired capital stock, namely:

$$S^* = \frac{K^*}{\mu^*}$$

This simple model performs relatively well in the sample. In 2015, the global mobile association GSMA estimated that the stock of mobile internet users was close to 3.0 billion.[6] Given that mobile internet is what distinguishes smartphones from regular mobile phones, this figure is used as a proxy for the stock of smartphones currently in use in the world (K_{t-1}). The growth rate (γ_t) in the stock of global smartphones was 4.8 percent in 2016. The worldwide replacement rate (μ_t) in 2016 was estimated by Morgan Stanley at 2.34 years.[7] With these estimates, the expected smartphone sales from the model would be 1.406 billion for 2016, close to the actual sales of 1.473 billion. For 2017, the model forecasts sales of 1.411 billion, compared with actual sales of 1.472 billion. For 2018, the figures are 1.461 billion vs. actual sales of 1.371 billion.[8]

This simple model can also be calibrated to derive a forecast of future smartphone sales. The global mobile association GSMA estimated the stock of mobile internet users in the world was 3.6 billion in 2018. The growth rate of mobile phone lines in the world was about 2 percent in 2019, equivalent to the growth rate of smartphones (γ_t) if the share of smartphones to total mobile phones (currently 60 percent) remains unchanged. This assumption will be relaxed below to test for different assumptions. The average replacement cycle in 2018 was about 2.8 years in the US and Korea (see Appendix I). Morgan Stanley (2017) also projected a similar figure for 2018 for the average worldwide replacement cycle in the study published in 2017. In addition, the replacement cycle continues to lengthen as the secondary market for used smartphones has grown faster than the primary market in 2018.[9] Based on these studies, the worldwide average replacement cycle (μ_t) is calibrated to be 2.9 in 2019, and to grow steadily to 3.5 years over the period 2020-24 as users continue to slow the replacement of their smartphones and the secondary market continues to grow.

Based on this calibration, the baseline forecast using the model described above shows a steady decline in global smartphone sales over the next five years (red line in Figure 4). The decline is driven by the gradual increase in the global replacement cycle (μ_t), which more than offsets the growth (γ_t) in the stock of global smartphone sales (red line in Figure 5).

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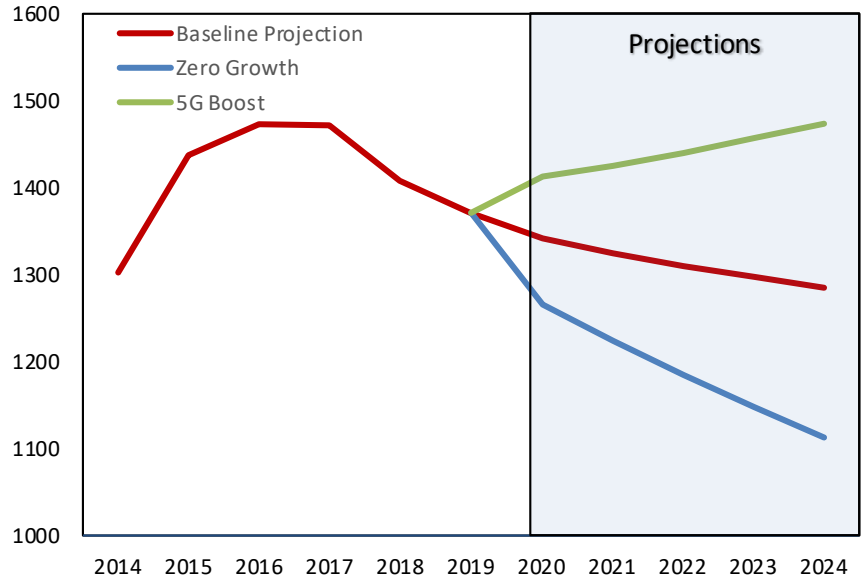
[6] GSMA Intelligence (2016). The definition used here is different from the number of mobile smartphone connections also reported by GSMA as those connections may not be for unique smartphones.

[7] Morgan Stanley (2017). See also Appendix I.

[8] These are in-sample static forecasts, based on actual data of K_t, γ_t, and estimates of μ_t.

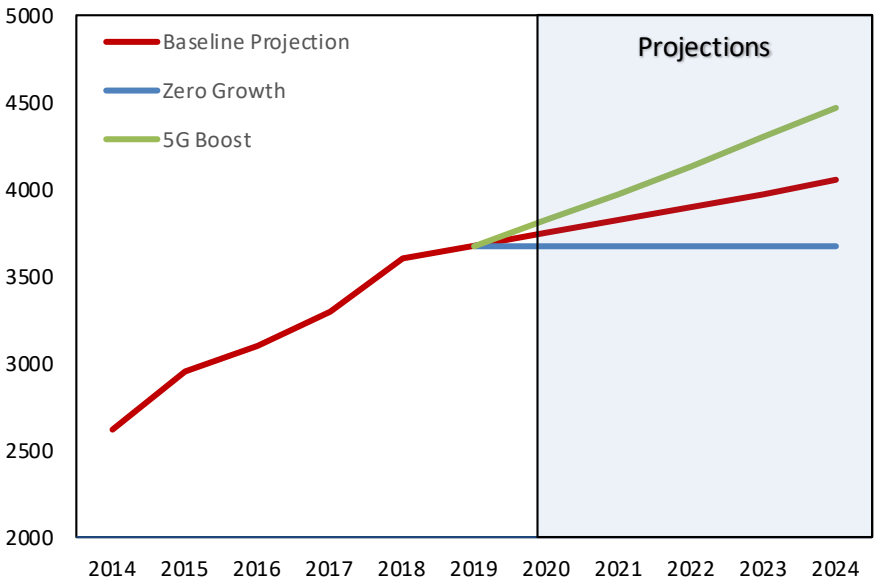
[9] Realwire (2019).

Figure 4. Global Sales of Smartphones
(Millions of Units Sold Each Year)



Sources: IDC and authors' projections for 2020-24.

Figure 5. Global Stock of Smartphones
(Millions of Units in Use Each Year)



Sources: GSMA 2016-19, and authors' estimates for 2019 and projections for 2020-24.

In other words, even if the stock of global smartphones continues to grow, sales would decline as existing users lengthen the time they hold on to their existing smartphones. Accordingly, global sales are forecast to fall to less than 1.3 billion per year by 2024, while the stock would rise to over 4.0 billion units.

There is, however, significant uncertainty surrounding this forecast. A possible downside scenario to this baseline projection is given by the assumption of zero growth in the stock of global smartphones. This scenario could be motivated by the smartphone penetration having peaked for now. However, it does not represent a steady state as the replacement cycle would continue to lengthen over the forecast horizon. In this scenario (represented by the blue line in Figure 4 and 5), the stock of smartphones would remain at the current level of 3.6 billion and sales would fall to less than 1.1 billion per year by 2024.

Finally, the introduction of the 5G network and compatible smartphones could represent an upside scenario, or there could be other innovations that would shorten the replacement cycle. In this scenario, a combination of higher growth and/or a shorter replacement cycle could result in a recovery in sales to about 1.5 billion by 2024, while the stock of smartphones would grow somewhat more rapidly over the medium term.[10] Overall, this scenario would suggest that there is still room for further growth in the global smartphone sales if innovation leads users to replace smartphones more rapidly.[11]

IV. Shift to Embedded Services

The largest smartphone producers have diversified recently by providing embedded services to boost revenues. Embedded services are services that can be run through the smartphone's operating system and thus provide an extra incentive to use a specific type of smartphone. These services include mobile cloud services (applications, backups, files, photos, videos, etc.); content subscription services (music, news, movie and TV streaming, and videogames); and financial services. While worldwide data on exports of these services are not available, recently-published data from the US Bureau of Economic Analysis (BEA) show a significant rise in US services exports associated with these services, while US services imports confirm that most of these services come from advanced economies.

Mobile cloud services have grown significantly in recent years and are expected to boom over the next decade. In 2019, the market for mobile cloud services was estimated at $31 billion and was dominated by the largest cloud computing providers (Apple, Amazon AWS, IBM, Google, Microsoft, and Oracle), which are mostly based in the US.[12] Profits for mobile cloud services are likely to grow rapidly in the coming years and will continue to flow mostly to the US in the form of services exports of Information, Communication, and Technology (ICT) services.

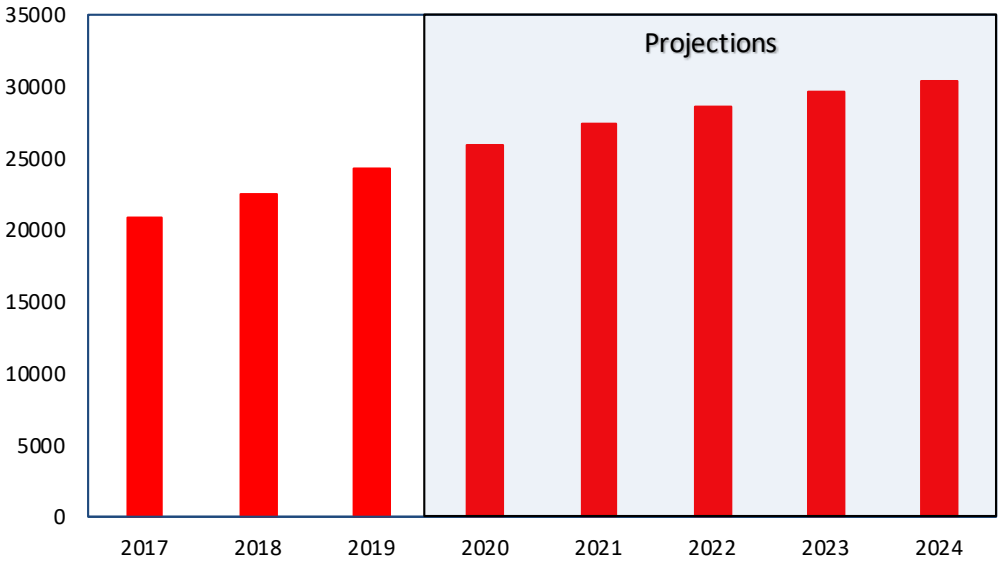
[10] The 5G Boost scenario shown here is based on a higher growth rate of 4 percent per year. However, the results could come from a combination of higher growth or a shorter replacement cycle, giving similar results in terms of higher smartphone sales.

[11] See also a similar forecast by IDC (2019), where they predict a recovery in smartphone sales based on the introduction of the 5G network.

[12] Modor Intelligence (2020).

A second area of growth in recent years has been content subscription services. This includes music, news, movie and TV streaming, and videogame subscriptions. The main producers of smartphone operating systems (Apple IOS and Google Android) have recently sought to catch up to the fast growth of independent companies (e.g., Amazon Prime, Netflix, Spotify) by embedding services into their own operating system (Apple Arcade, Music, News+, and TV+; and Android Google Play). Such subscription services are growing rapidly around the world, in part by replacing traditional over-the-air or cable media services. Video streaming services, for example, have seen rapid growth worldwide over the last few years and are expected to reach $30 billion by 2024 (Figure 6). Royalties from these services will mostly accrue to producers residing in advanced economies, notably the US, in the form of potentially ICT-enabled services.

Figure 6. World Video Streaming Services
(Millions of USD)



Source: Statista (2020).

Financial services are a third area where smartphone producers are trying to catch up to early adopters. As widely documented, financial services through mobile phones have had rapid growth over the last two decades particularly in less developed countries where access to traditional financial services are lacking or more difficult to reach.[13] The best known example is Alipay, a subsidiary of the Alibaba Group, which had over 870 million users in 2018 and accounted for more than half of third-party payments in China.[14] More recently, smartphone

[13] See, for example, IMF (2019).

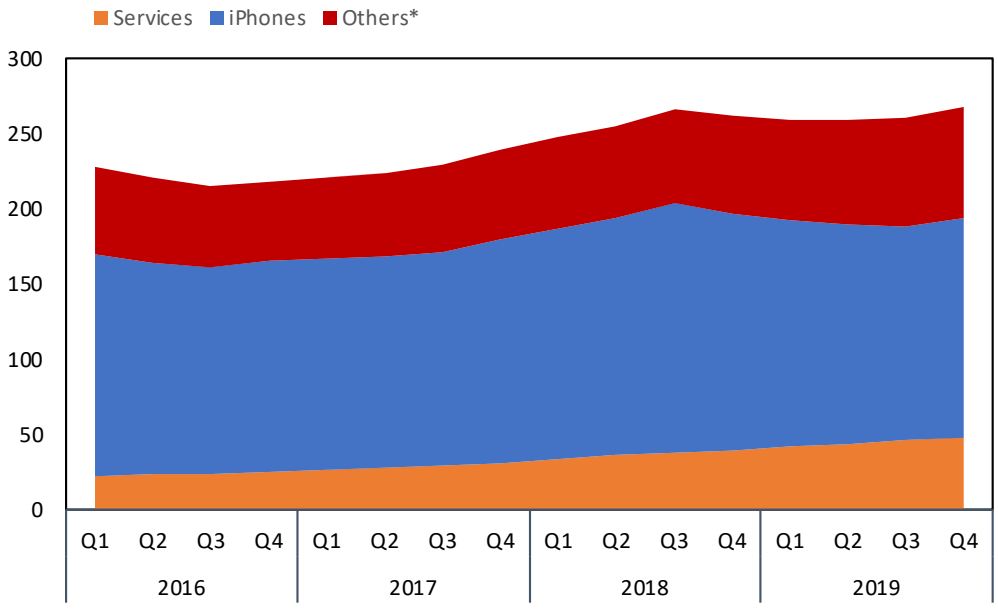
[14] Wikipedia (2020a).

(continued…)

producers have sought to catch up through the integration of financial services into their operating system. Apple Cash was introduced in the US in October 2014 and is now available for both domestic and international transactions in 80 countries.[15] Google Pay (previously known as Google Wallet) was introduced in the US in 2015 and has a more limited international presence in 30 countries. These services will again boost potentially ICT-enabled financial services in advanced economies where financial entities managing these services reside.

The best example of this shift to embedded services comes from Apple Inc. The company has been expanding the set of embedded services associated with its IOS operating system. It started providing cloud services through iCloud in 2011 and has now more than an estimated 850 million iCloud users.[16] More recently, it introduced content subscriptions for unlimited music, news, TV and movies, and videogames. It also started providing financial services like Apple Cash and the Apple Card, the latter in collaboration with Goldman Sachs. These embedded services have significantly boosted Apple Inc. revenues. Apple Inc.'s revenue from services has steadily increased since the first quarter of 2016 and accounted for $48.1 billion (13.8 percent of total revenue) in 2019, while revenues from iPhone sales have been steadily declining since the third quarter of 2018 (Figure 7).

Figure 7. Apple Inc. Revenues
(Billions of US dollars, Cumulative Sum of the Preceding Four Quarters)



* iPads, Mac, and other products.
Source: Apple Inc. quarterly financial statements (quarters shown are calendar and not fiscal year).

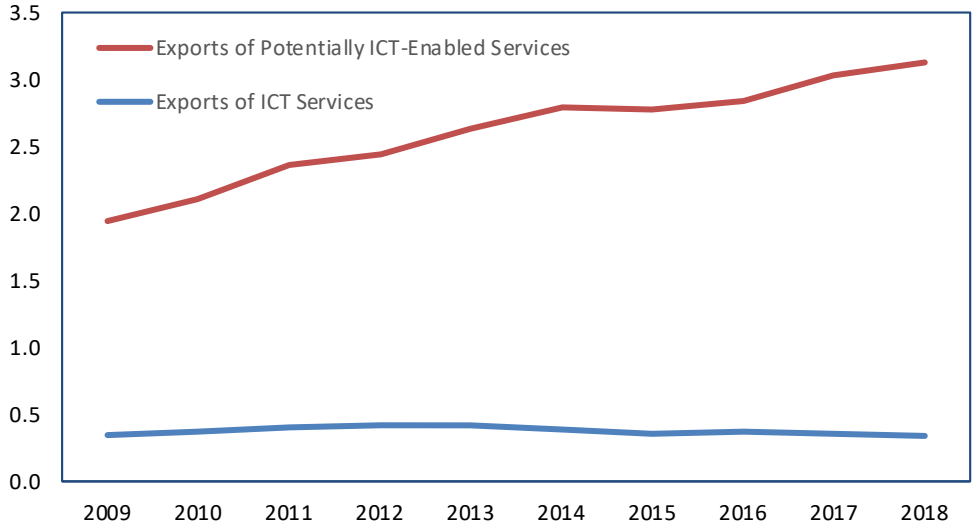
[15] Wikipedia (2020b)

[16] Wikipedia (2020c).

(continued…)

This move to embedded services is likely to imply a shift in global trade in favor of services exports from advanced economies. The BEA has recently published estimates on ICT services and potentially ICT-enabled services as part of its efforts to quantify the digital economy.[17] ICT services are defined as services used to facilitate information processing and communication, while potentially ICT-enabled services are services that can *predominantly* be delivered remotely over ICT networks. As shown in Figure 8, US services exports of potentially ICT-enabled services have grown rapidly since 2009 and accounted for more than 3 percent of GDP in 2018, while the share in GDP of ICT services remained broadly flat. The growth in potentially ICT-enabled services in the US has coincided with the meteoric rise in smartphone use, suggesting that a significant portion of this growth may be the result of the use of those services through smartphones. Causality here cannot be inferred, but the fact that PC sales were declining during the same period provides additional evidence supporting the view that smartphone use was the main driver of the growth in those services. Furthermore, most US imports of potentially ICT-enabled services came from advanced economies in 2018, except for India where US outsourcing of IT and telecommunication services has created a vibrant ICT service industry. This suggests that advanced economies may be the main beneficiaries of the recent move to embedded services. However, trade data on potentially ICT-enabled service from other advanced economies are unfortunately unavailable to confirm this hypothesis.[18]

Figure 8. US: Exports of ICT and Potentially ICT-Enabled Services
(Share of US GDP)

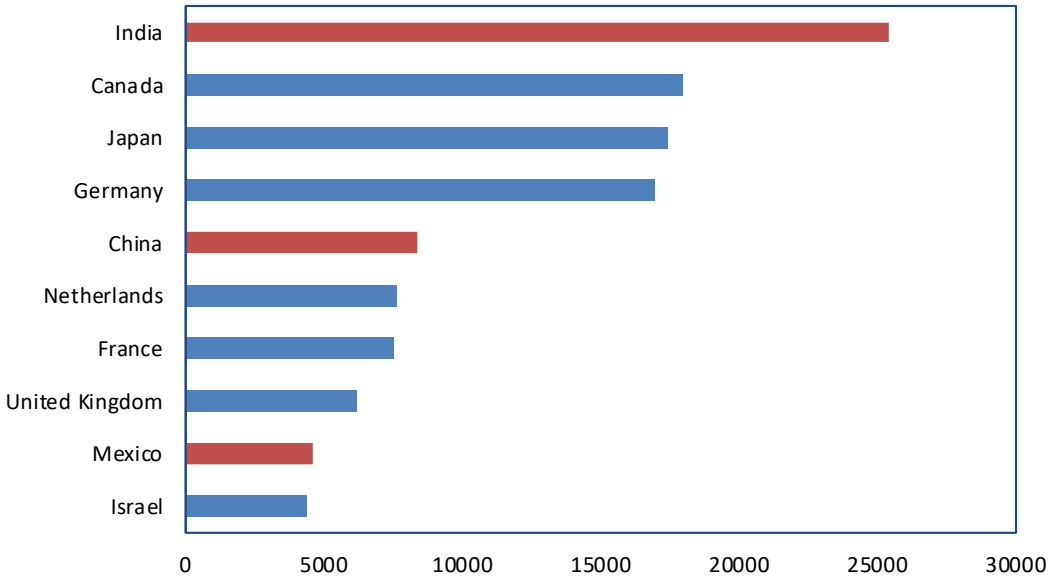


Sources: US Bureau of Economic Analysis.

[17] Bureau of Economic Analysis (2020).

[18] Grimm (2016) provides estimates of ICT services and potentially ICT-enabled services for OECD countries for the period 2010-14, accounting for 67 percent of world exports and 58 percent of world imports in 2014. These estimates show a significant increase in potentially ICT-enabled services during that period, mostly arising from advanced economies.

Figure 9. US: Imports of Potentially ICT-Enabled Services by Country, 2018
(Top 10 countries; advanced economies marked in blue; millions of US dollars)



Sources: US Bureau of Economic Analysis.

The shift to embedded services could also make the tech cycle less pronounced. As shown in the earlier working paper (WP/18/22), the launch of new global smartphones would lead to significant volatility in high-frequency global trade data—the so-called tech cycle—that could not be captured by standard seasonality adjustments given that the timing of the launch would vary each year. With the expected lower contribution to trade from merchandise tech exports associated with global smartphone production and the rise of embedded services exports, it is likely that the volatility of the tech cycle will diminish in the future.

Overall, the shift to embedded services, together with other forthcoming services like Facebook's Libra, suggest that the tech cycle could be morphing into one driven more by services than hardware. While it is hard to gauge its effect on global trade quantitatively, qualitatively a plausible impact could be a shift away from merchandise exports from Asia to services exports, mainly from advanced economies, in the form of financial services and royalty payments for music, movies, news and TV programming. US data on potentially ICT-enabled services provides some evidence that supports this hypothesized evolution.

V. CONCLUSIONS

This paper provided an update on the evolution of the sale of smartphones in recent years. It showed that smartphone sales appear to have peaked in 2016 suggesting that the global smartphone market may have become saturated. A simple forecasting model predicts that sales of smartphones could continue to decline over the next five years, given slower growth in the penetration of smartphone users and longer replacement cycles. However, there is significant uncertainty around this forecast and the trend could be reversed if the introduction

of the 5G network or other innovations raise demand for new smartphones more rapidly than expected. The shift to embedded services, like cloud storage, content subscription, and financial services, could imply a shift in the composition of the underlying trade driving the tech cycle away from merchandise exports from Asia toward services exports mainly from advanced economies. This would in turn dampen the high frequency variability that the tech trade has imparted on overall global trade in the recent past.

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Appendix I-The Lengthening of the Replacement Cycle

A key to the recent decline in global smartphone sales is the lengthening of the replacement cycle, namely the average time smartphones are in use before being discarded. The longer the replacement cycle, the lower the amount of smartphone sales. In addition, to the extent that the replacement cycle lengthens as a result of the development of the secondary market for used smartphones, it could imply also a lower growth rate in the overall stock of smartphones given that smartphones that would previously be discarded are now resold to other users.

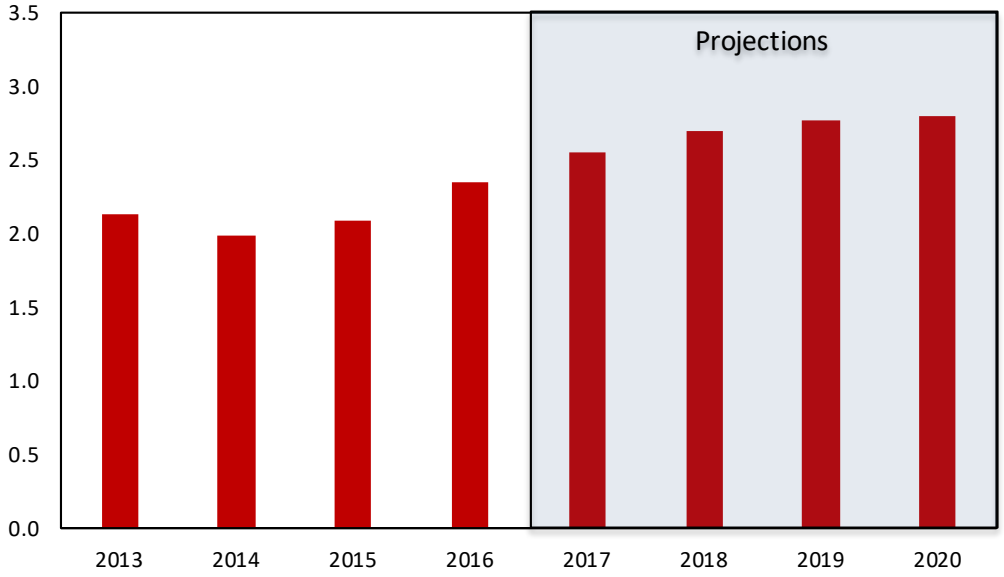
Data on the worldwide average replacement cycle for smartphones is limited. A study by Morgan Stanley (Morgan Stanley 2017) estimated the worldwide average replacement cycle rising from 2.1 years in 2013 to 2.6 years in 2016 and projected a further increase to 2.8 years by 2020 (Figure A.1). More recent estimates on the average replacement cycle are only available for a couple of countries. In the US, the replacement cycle has been going up for both consumers and enterprises (Figure A.2). In 2019, it rose to 2.88 years for consumers and 2.56 for enterprises.[19] It is likely, though, that these figures understate the replacement cycle as they do not account for the sale of these smartphones in the secondary market. In Korea, a survey in September 2018 found that the average user replaced its smartphone every 2.8 years, with a significant distribution on both sides (Figure A.3).[20] This again, however, may not account for the sale of these used smartphones in the secondary market.

The rapid growth of the secondary market is likely to lengthen the replacement cycle further. As older models are sold in the secondary market, the lifespan of a smartphone is likely to increase further. B-Stock, a business-to-business marketplace for trade-in and overstock mobile phones and devices, estimates that the used smartphone market is growing faster than the primary market, and that the average smartphone will be used by two to three people before it is scrapped. In addition, Apple Inc. introduced a trade-in program in 2017 that allows iPhone users to trade in their phones for a discount on newer models. The older iPhones are then refurbished and sold at lower prices. These trends in the secondary market are likely to become even more important in the future, thus lengthening further the replacement cycle and reducing the sales of new smartphones.

[19] Daniels Research Group (2019).

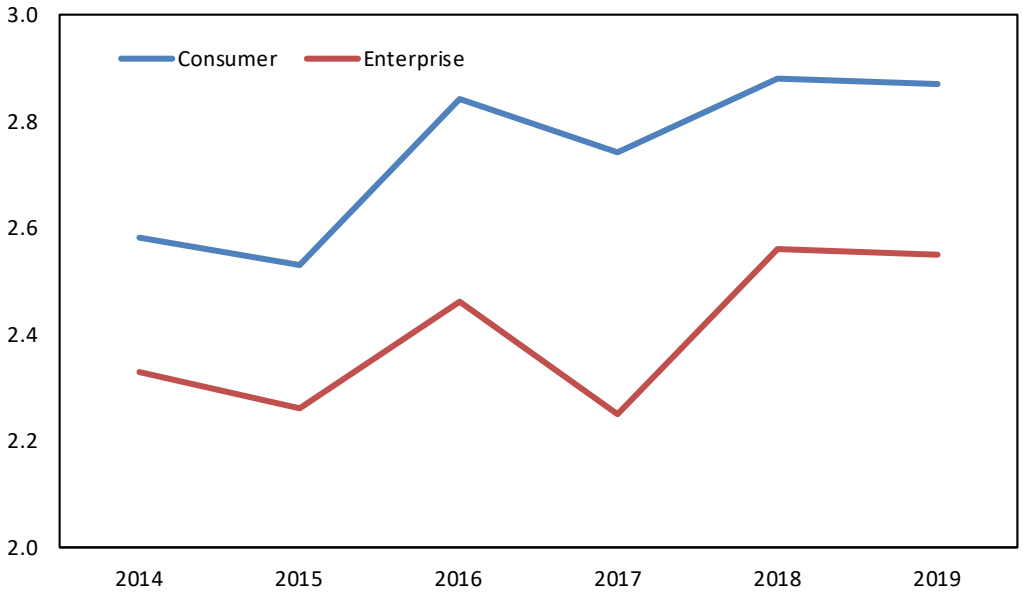
[20] Korean Internet & Security Agency (2019).

Figure A.1. Worldwide Average Replacement Rates, 2013-20
(Years)



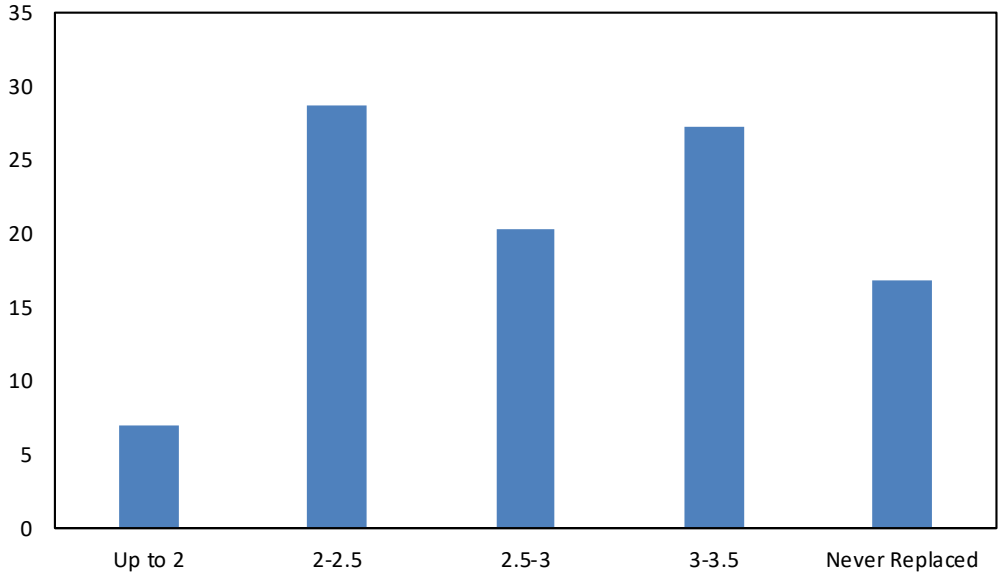
Source: Morgan Stanley (2017).

Figure A.2: US: Average Replacement Cycle of Smartphones, 2014-2019
(Years)



Source: Daniels Research Group (2019).

Figure A.3. Korea: Survey on Smartphone Replacement Cycle, September 2018
(Years)



Source: Korean Internet and Security Agency (2019).